

comprises a supporting means for supporting the crucible and wherein the process further comprises controlling a flow rate or a temperature of a cooling medium flowing in the supporting means to control the temperature of the fluoride-crystal growth furnace.--

REMARKS

Claims 58-60 are now presented for examination. Claims 33-36, 39, 56 and 57 have been cancelled without prejudice. Claims 58-60 have been added to provide Applicant with a more complete scope of protection.

Claim 58 is the only independent claim.

Claims 33 to 36, 39, 56 and 57 were rejected under 35 U.S.C. § 103 as obvious from U.S. Patent 5,037,621 (Kennedy et al.) in view of U.S. Patent 6,123,764 (Mizugaki et al.). Cancellation of those claims renders their rejection moot.

Support for new Claim 58 is found in the specification at page 40, line 18 to page 41, line 7, page 55, line 26 to page 56, line 20, Example 1 and Figs. 24A and 24B. New independent Claim 58, is believed patentable over the prior art for at least the following reasons.

Claim 58 is directed to a process for producing a fluoride crystal by means of an apparatus comprising a fluoride crystal growth furnace having a crucible for holding a fluoride material, a heating means for melting the fluoride material, a moving means for moving the crucible relatively to the heating means, and a plurality of detecting means for detecting a temperature of the fluoride material. The process includes the steps of: detecting with the plurality of detecting means, a temperature in the vicinity of a bottom

center of the crucible and a temperature in the vicinity of a side of the crucible; and controlling based on a result of the detecting, a temperature inside the fluoride crystal growth furnace such that a temperature at the center of solid-liquid interface of the fluoride material in the crucible is made lower than a temperature in the vicinity of the solid-liquid interface of the fluoride material in the crucible.

Crystal growth in fluoride is very difficult when compared with crystal growth of other materials, some of the difficulties are enumerated as follows:

1. Since a fluoride material contains fluorine and has a high melting point and its chemical reactivity is extremely high, the only material that can be used for a crucible for holding the fluoride material is carbon. Therefore, molten quartz or glass or the like as disclosed in Kennedy cannot be used for an ampoule, and further, the temperature cannot be controlled by observing a shape of solid-liquid interface form outside, as taught in Kennedy.

2. Since the melting point of fluoride material is high (1360°C), when the crystallized material is cooled, it is highly likely to be broken or to remain strained if there is a temperature distribution in-plane.

3. Fluoride has a small heat transfer rate. When it forms a large crystal, it is difficult to control the temperature distribution. Therefore, crystal growth of fluoride cannot be effected by employing a method like the growth method for a KCl crystal having a low melting point (770°C), as is disclosed in Kennedy.

In fluoride crystal growth, like KCl crystal growth, it is important that the crystal is grown with an upward convex crystal surface shape. However the method as disclosed in Kennedy, in which the shape of solid-liquid interface is observed from outside,

cannot be employed for fluoride crystal growth for the reason mentioned in paragraph 1 above. The object of the presently claimed invention is to control a crystal growth furnace so as to facilitate an upward convex crystal surface shape by controlling temperature distribution in the solid-liquid interface. Independent Claim 58 has been drafted to make this point clear.

Mizugaki teaches that fluoride crystal is grown by the Bridgeman method. However, Mizugaki relates to a purification method of a crystal growth material. It does not relate to a method in which a crystal growth is directly controlled. Moreover, in view of the differences between the requirements for KCl crystal growth and fluoride crystal growth outline above, there would have been no motivation whatsoever to combine the teachings of these references, in any event.

None of the cited references, alone or in combination, teach or suggest the invention defined in independent Claim 58.

A review of the other art of record has failed to reveal anything which, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as references against the independent claim herein. That claim is therefore believed patentable over the art of record.

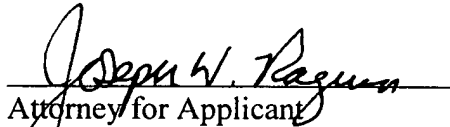
The other claims in this application are dependent from independent Claim 58 discussed above and are therefore believed patentable for the same reasons. Since those dependent claims are also deemed to define additional aspects of the invention, however, the individual consideration of their patentability on their own merits is respectfully requested.

This Amendment After Final Rejection is believed clearly to place this application in condition for allowance and its entry is therefore believed proper under 37 C.F.R. § 1.116. At the very least, however, cancellation of Claims 33-36, 39, 56 and 57 clearly eliminates all issues relating to those claims. Accordingly, entry of this Amendment After Final Rejection, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,


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